

Aviation Weather – Air Traffic Management Integration Study

Final Report

3 October 2007



NAS Operations Subcommittee

Research, Engineering
and
Development
Advisory Committee

Key Findings



- As much as two-thirds of the weather related delay is potentially avoidable
- A risk management approach with adaptive, incremental decision making, based on automatically translating weather forecasts into air traffic impacts, presents a major new opportunity for reducing weather related delays

Key Recommendations

A cross cutting research program, involving public and private sector air traffic management and aviation weather experts, is needed to exploit these key findings

Key Recommendations

- Identify and quantify avoidable delay
- Translate convective weather into ATC impacts
- Develop adaptive, integrated ATM procedures for incremental route planning
- Airspace Systems and ATM Decision Support Tools must be designed for Weather impacts, from the beginning

Summary

- Opportunities exist to reduce the weather related delay for both tactical 0-2 hours and strategic 2-10 hour planning horizons
- An integrated, cross disciplinary research program is needed for this to be successful

Backup Slides

Key Research Recommendations



- Weather Information must be translated into ATM Impacts

Case Studies of Avoidable Weather Delay*

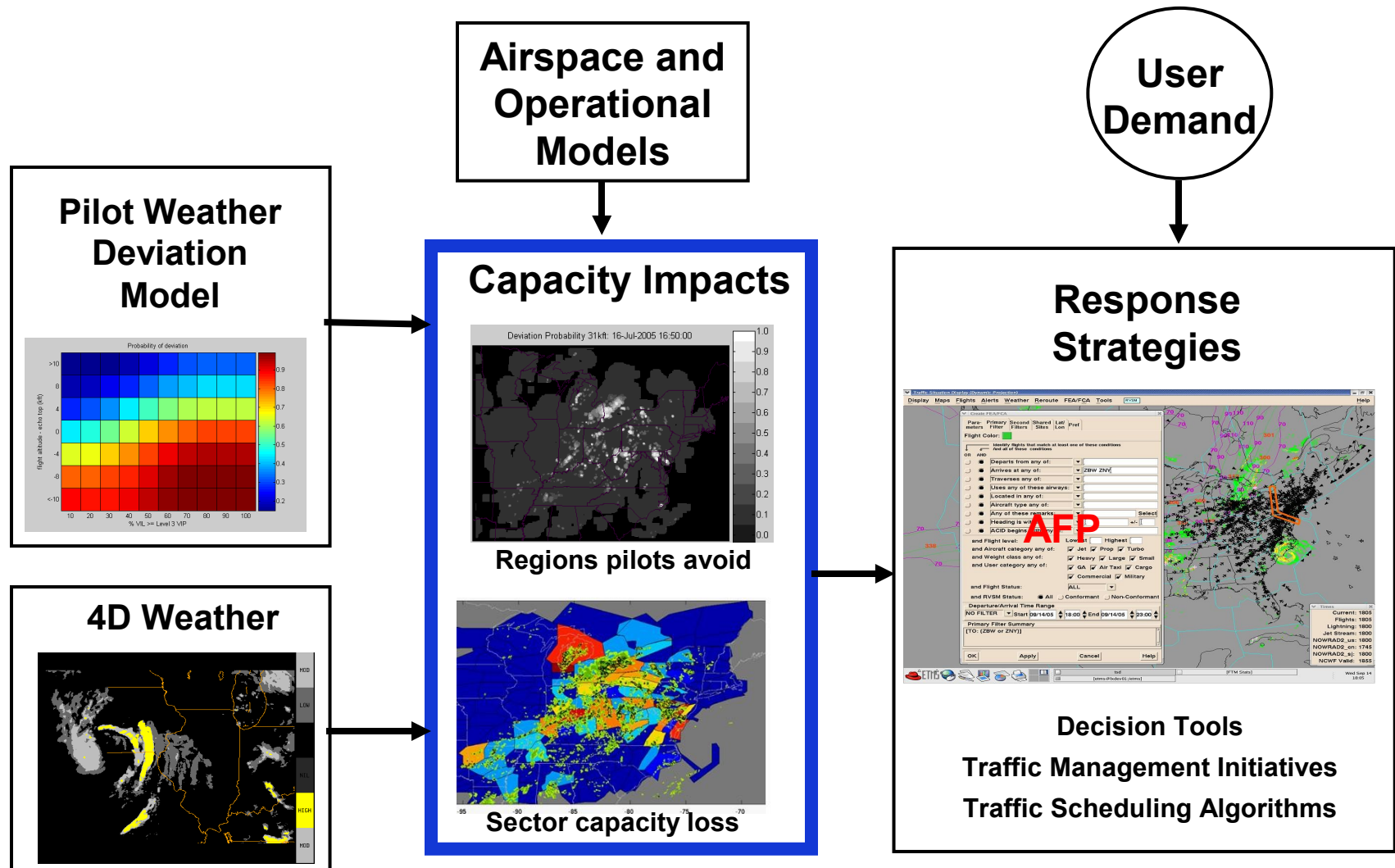
Eastern United States Flights during convective activity

	7/16/05 Actual	7/16/05 Possible	7/27/05 Actual	7/27/05 Possible	7/27/06 Actual	7/27/06 Possible
Ground Delay >15 min	31%	4%	25%	4%	42%	5%
Air Delay** >15 min	9%	5%	10%	9%	3%	7%
Total Delay (hours)	3997	69	5630	1840	6452	2236
# flights	13,340		15,648		16,328	

*Preliminary results

** Includes reroute time

Weather Translation into ATM Impacts



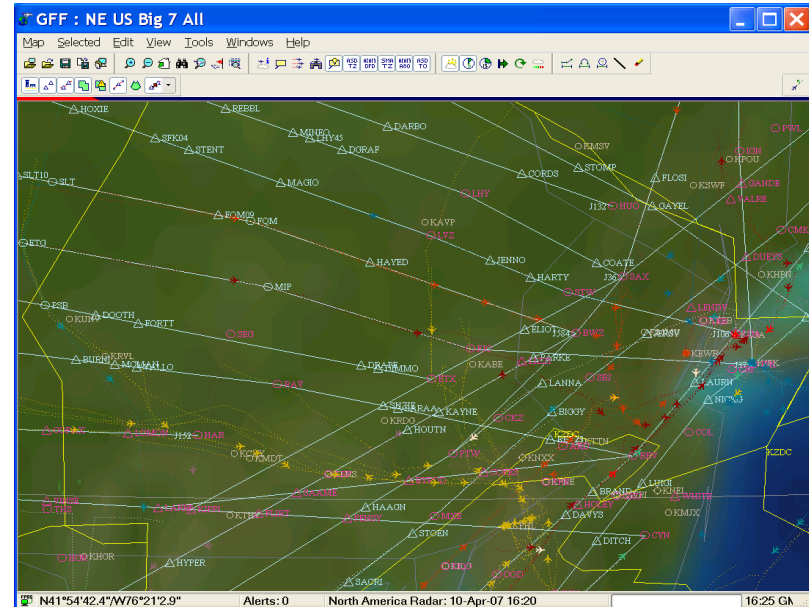
Key Research Recommendations



- Weather Information must be translated into ATM Impacts
- Airspace Systems and ATM Decision Support Tools must be designed for Weather impacts, from the beginning.

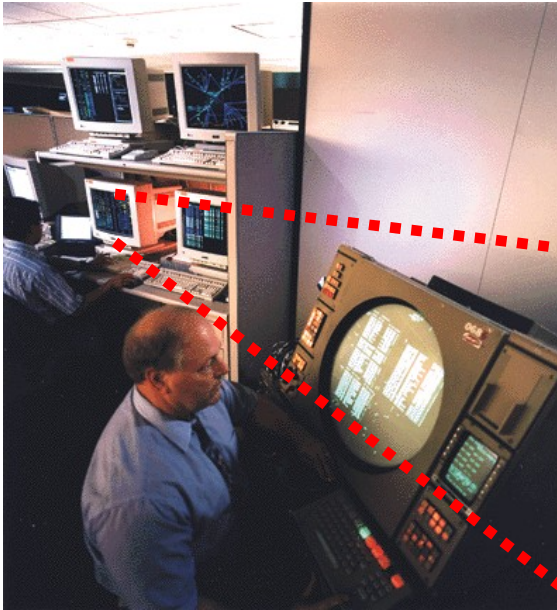
NAS Airspace is unable to respond to weather impacts

- Highly-structured
- Rigid networks of routes
- Complex Coordination



Research is needed to create flexible airspace designs that can adapt to weather impacts

Most ATM Decision Support Tools are built on Fair Weather assumptions



Traffic Management Advisor helps TMUs sequence arriving flights within seconds



With Thunderstorms, TMUs abandon TMA, impose miles-in-trail and sequence arriving flights within 10-15 minute blocks

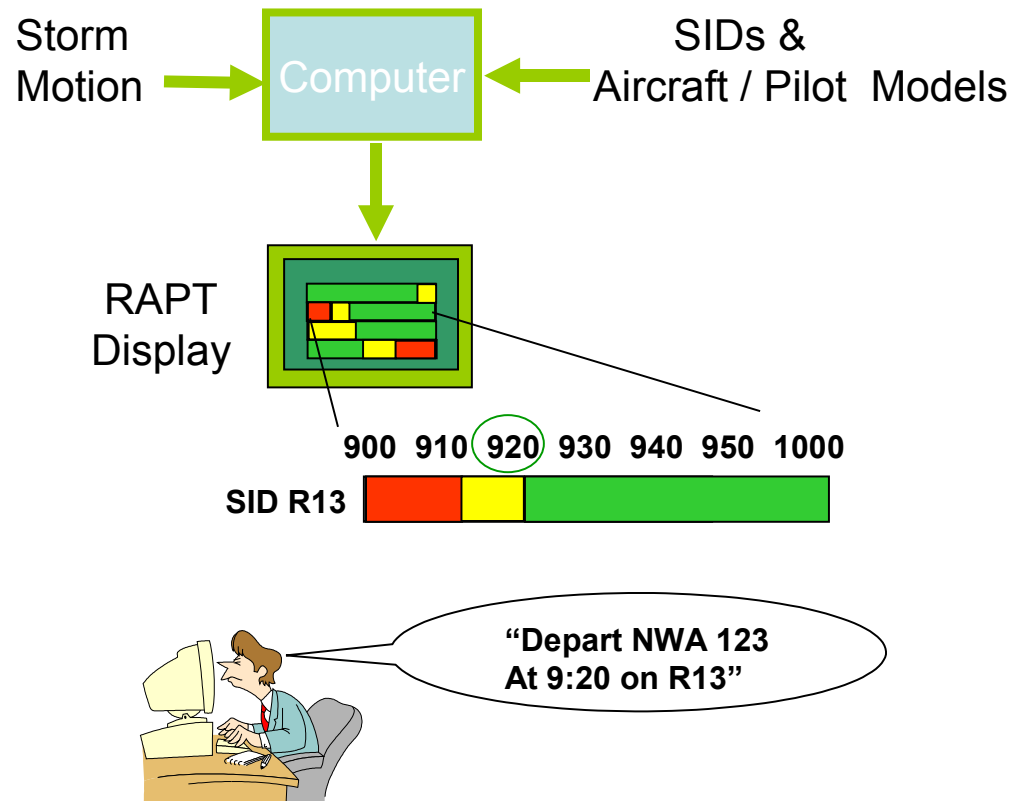
1724: 36

AID	SOUTH_VFR_BAL	W	CID	MFN	M/STA	M/ETA	DAL ARR: 42
BP							
>MXP1091	L 949	BP	1909	1909			
>AAL1998	H 848	BP	1825	1825			
>AAL403	L 504	BP	1823	1823			
>ASE656	S 983	BP	1818	1818			
N70HJ	S 790	BP	1801	1801			
>EGF744	L 839	BP	1804	1804			
>DAL930	L 858	BP	1804	1804	370 C		
AAL744	L 845	BP	1747	1747	1080 504		
AAL802	L 516	BP	1745	1744			
UAL478	L 894	BP	1744	1744			
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@AAL1668	L 808	BP	1729	1726			
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>AAL222	L 810	BP	1725	1719			
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>DAL994	L 911	BP	xxxx	1708			
>SWA1063	L 536	BP	xxxx	1705			

DSTs must be integrated with Weather when they are developed!

An early Weather/ATM Integration Success

Route Availability Planning Tool - RAPT



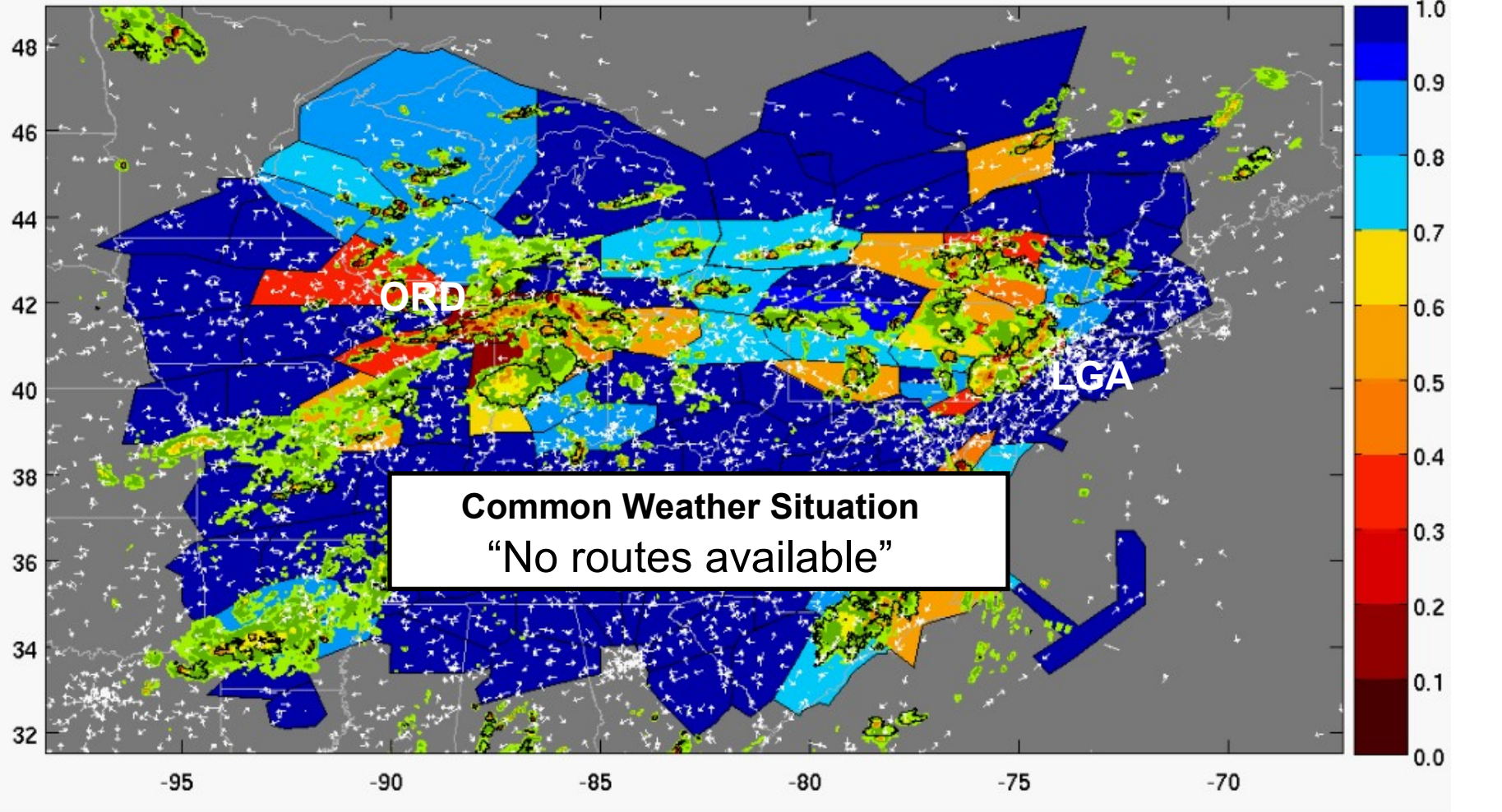
Key Research Recommendations



- Weather Information must be translated into ATM Impacts
- Airspace Systems and ATM Decision Support Tools must be designed for Weather impacts from the beginning
- Adaptive Decision Making must be developed to address uncertainty

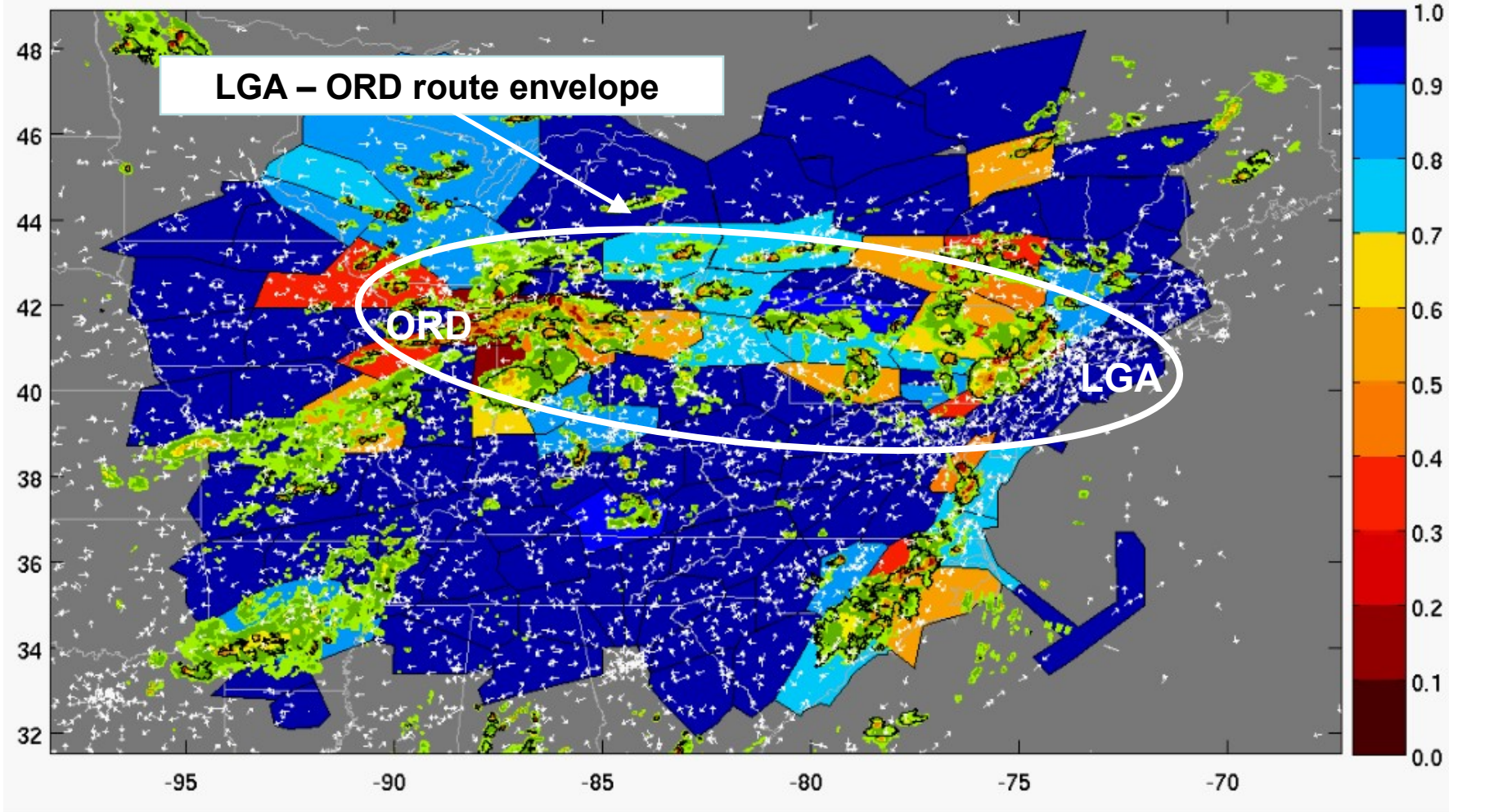
Flying LGA to ORD in Weather

20060727-225400 UTC



Adaptive ATM

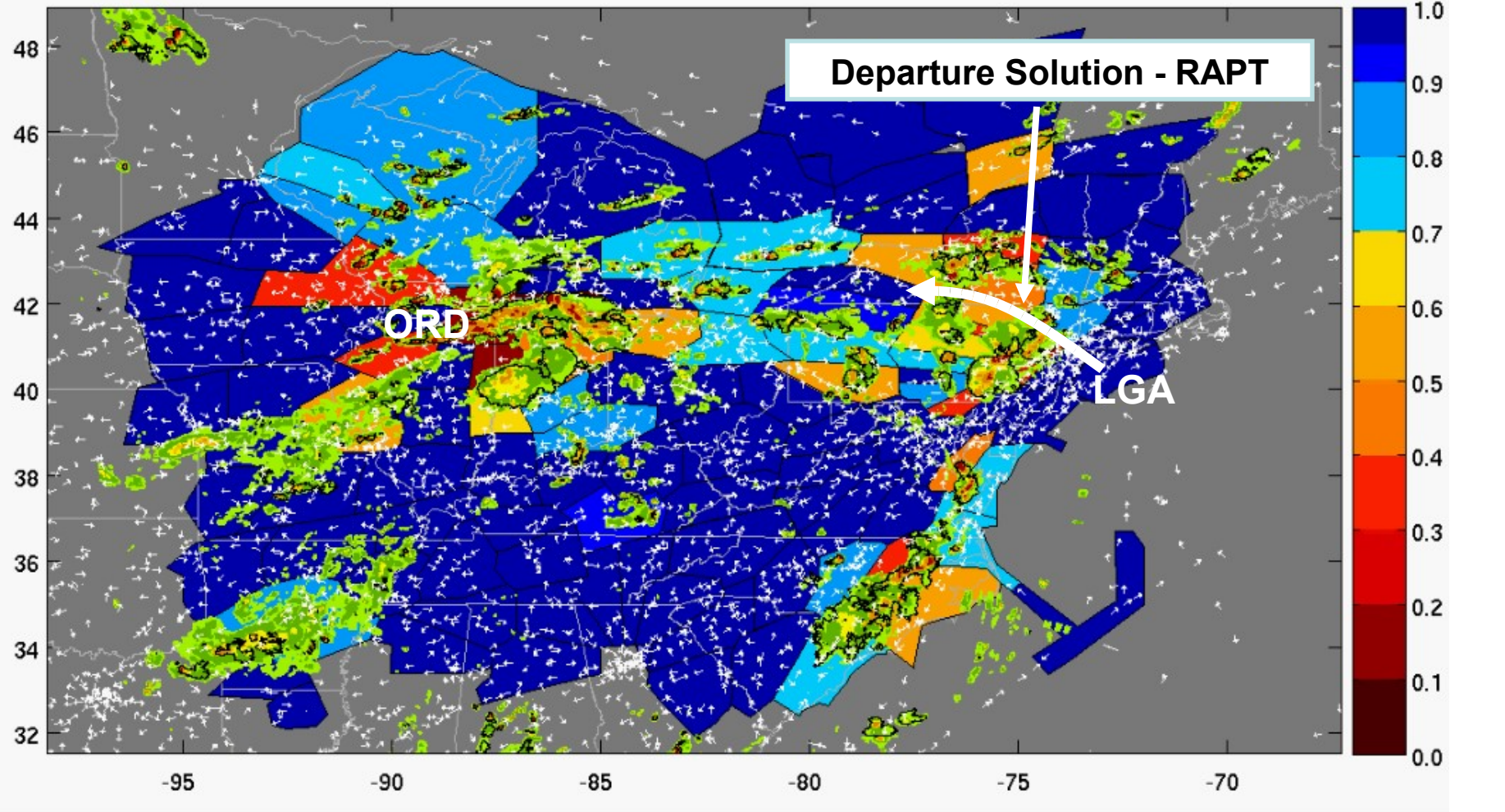
20060727-225400 UTC



Incrementally define Route and Decision Points

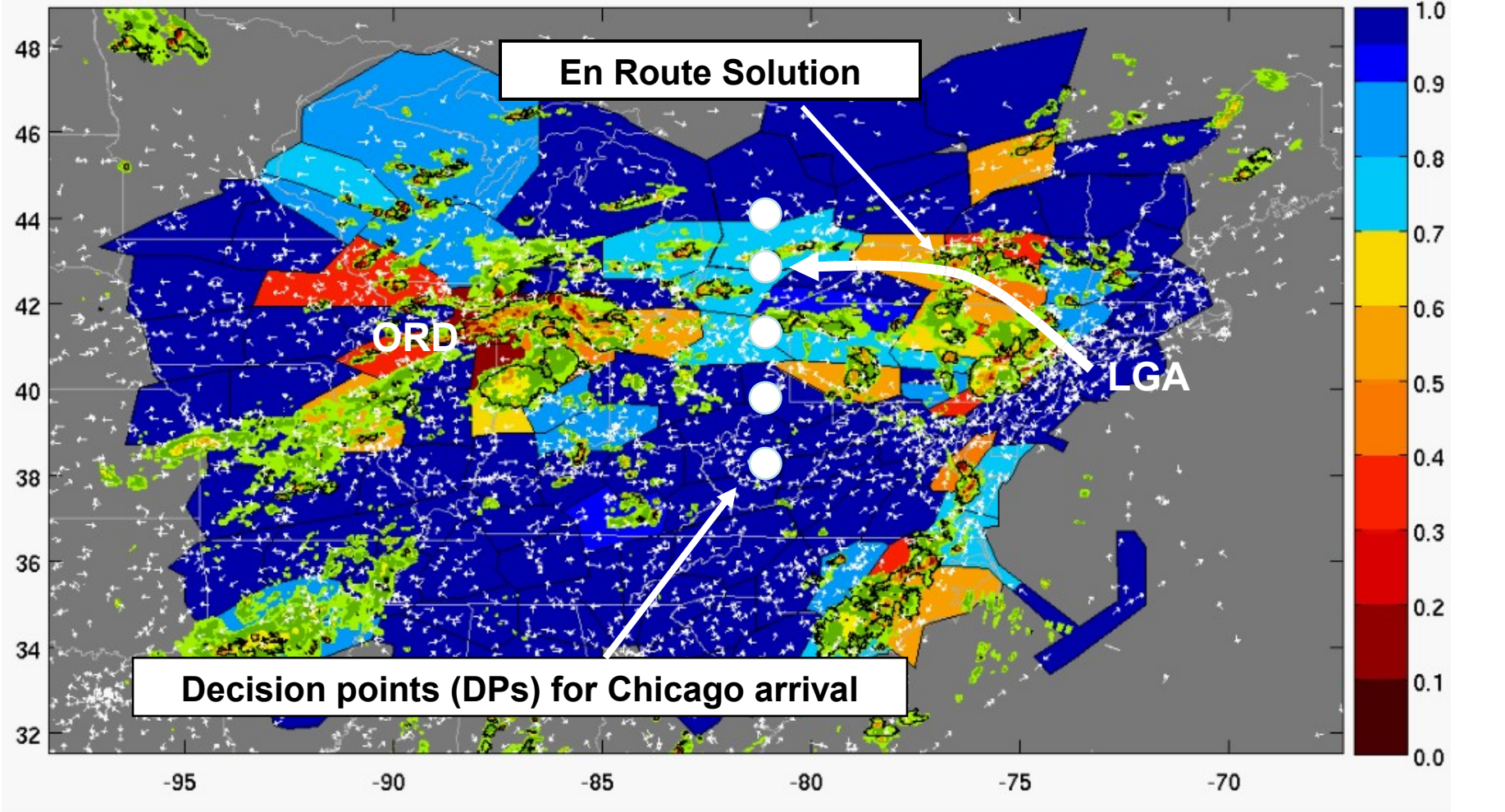
Adaptive ATM

20060727-225400 UTC



Adaptive ATM

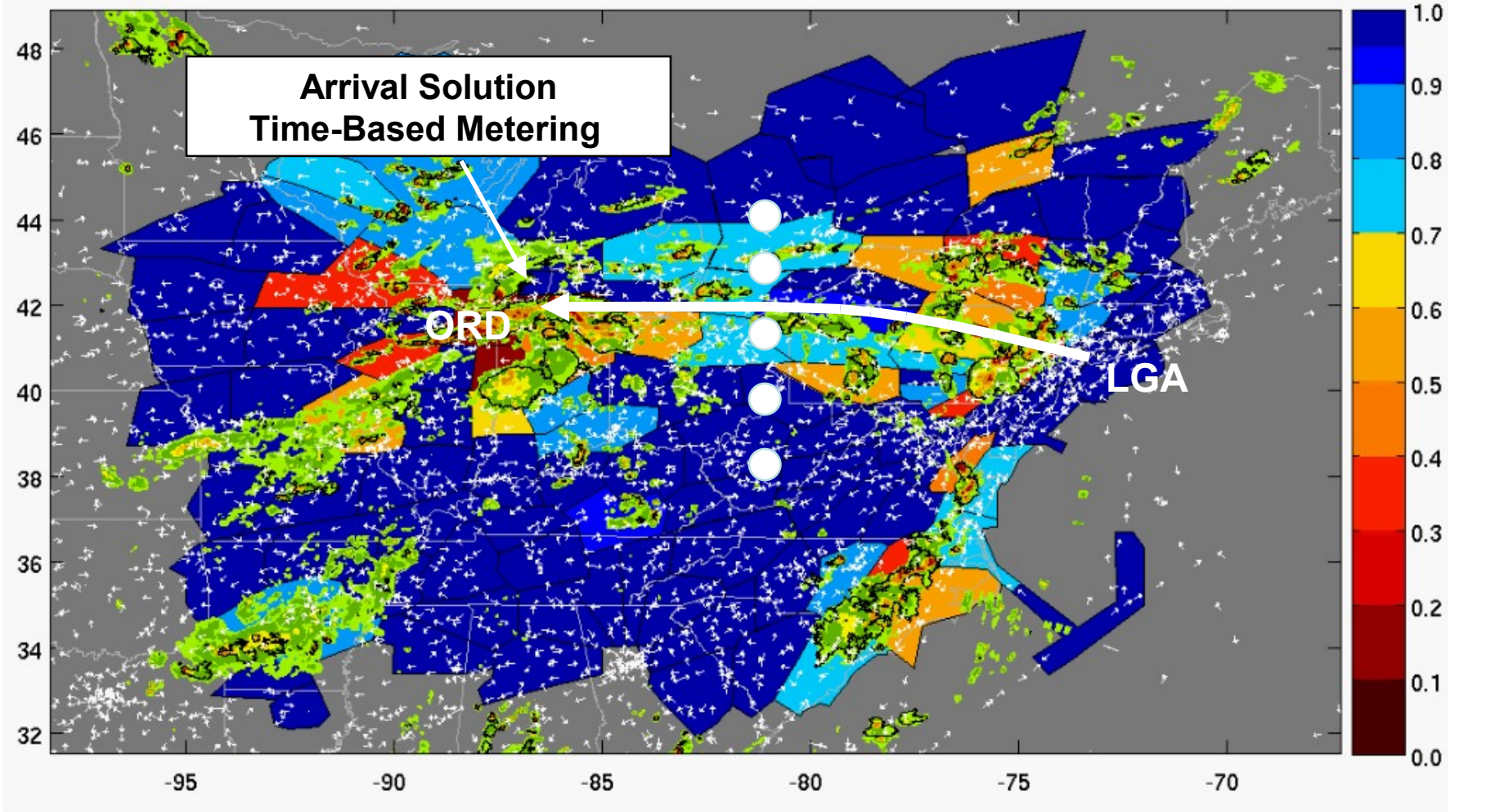
20060727-225400 UTC



As the flight progresses, Uncertainty is reduced

Adaptive ATM

20060727-225400 UTC



Adaptive Decision Making

Adaptive:

- Delay decisions until uncertainty is reduced
- Develop contingency plans and decision points
- Identify flight-specific decisions per phase of flight

Distributed:

- Distribute the decisions to lowest level possible

Example: Slot substitutions versus first-come-first serve